

Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

October 28, 2004

Inspection and Rating of PPC Deck Beam Bridges

County Engineers/Superintendent of Highways
Municipal Engineers/Directors of Public Works
Consulting Engineers

#04-13

The Illinois Department of Transportation (IDOT) has received the final reports for a research project sponsored by IDOT and performed by the University of Illinois at Urbana-Champaign (UIUC) to develop guidance for evaluating the existing condition of Precast Prestressed Concrete (PPC) Deck Beam Bridges. The reports are titled:

“TEST TO FAILURE OF A 54 FT. DETERIORATED PRETENSIONED
PRECAST CONCRETE DECK BEAM” (FHWA-IL-UI-281)

“STRUCTURAL CONDITION ASSESSMENT AND SERVICE LOAD
PERFORMANCE OF DETERIORATED PRETENSIONED DECK BEAM
BRIDGES” (FHWA-IL-UI-285)

A major finding of the UIUC research is that the prestressed strands in deck beams corrode at an accelerated rate even when not directly exposed to the elements. Once the conventional reinforcement bars in the beams, such as the “stirrup” shear reinforcement bars or wire mesh, are exposed and subject to active corrosion, all prestressed strands in the vicinity of the corroding reinforcement bars are affected and corrode at a rate beyond that of the conventional reinforcement bars or wire mesh. The research also directed attention to areas on a beam’s surface that exhibit discoloration that may indicate the presence of active corrosion, even though reinforcement bars have not been exposed. Once corrosion has initiated within a prestressed strand, the research concluded that the rate of corrosion is sufficient to consider the strand as having lost its ability to carry load. Based on the research findings, the Bureau of Bridges and Structures (BBS) has developed the attached guidelines for personnel performing the structural analysis to determine the safe load carrying capacity of PPC deck beam bridges.

The reports also noted that a major factor affecting the performance of PPC Deck Beam Bridges is the degree to which the structure is exposed to deicing agents. Since deicing agents are applied to a lesser degree on the local highway system, most bridges of this type under the jurisdiction of local agencies are performing adequately and have not experienced deterioration to the same degree as those structures on the state highway system.

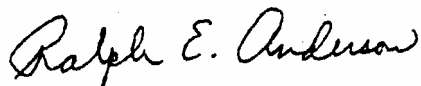
However, there are structures on local highways that carry relatively high volumes of traffic and are routinely exposed to deicing agents. Local agencies should be especially thorough in their inspection of PPC Deck Beam Bridges that are exposed to deicing agents and should look closely at areas of concrete discoloration and delamination. Removal of delaminated concrete is essential for determining the effect of deterioration on prestressed strands, especially in regard to beams that have been routinely exposed to deicing agents.

Based on the research findings, the guidelines for determining the condition rating for Superstructures composed of "Prestressed Concrete Beams" (Item #59) were revised. The guidelines currently contained in the Illinois Structure Information and Procedure (SIP) Manual, having an "Effective Date" of July 1, 2002, reflect the research findings and are appropriate for use during Routine NBIS Inspection. In comparison to previous condition rating guidelines, the current guidelines can provide significantly lower condition ratings.

We are providing the above guidelines to personnel performing inspections to illustrate the need to closely inspect PPC deck beams and to remove unsound concrete to accurately determine beam condition ratings during the next Routine Inspection. For structures with PPC deck beams in poor condition an unscheduled inspection may be required to verify the accuracy of the Superstructure condition rating. The condition ratings assigned by field inspection personnel during Routine NBIS Inspections is the mechanism that alerts the BBS to the need for a Damage Inspection.

If you have any questions, please contact Jayme Schiff at 217/785-8748.

Very truly yours,

A handwritten signature in black ink that reads "Ralph E. Anderson". The signature is written in a cursive, flowing style.

Ralph E. Anderson
Engineer of Bridges and Structures

JKK:

cc Illinois Department of Natural Resources
Norman R. Stoner Attn: Daniel R. Brydl

Attachment

GUIDELINES FOR ESTIMATING STRAND LOSS IN STRUCTURAL ANALYSIS OF PPC DECK BEAM BRIDGES

Prestressed strands incorporated in the PPC Deck Beams shall be disregarded during analysis for load carrying capacity based on the following observed conditions:

LONGITUDINAL CRACKS

- 1) Cracks observed in the middle area of the beam underside, with or without rust stains or other discoloration of the concrete adjacent to the cracks:
Disregard all strands from all rows of strands that may be located adjacent to the cracks.
- 2) Cracks observed along the edges of the beam underside, with or without rust stains or other discoloration of the concrete adjacent to the cracks:
Disregard at least the strands located adjacent to the edge of the beam in the bottom row of strands. When the crack is extensive in length and its location varies in distance from the beam edge, disregard additional interior strands from all rows of strands that may be intersected by the crack.
- 3) Two longitudinal cracks observed crossing or meeting:
Disregard all strands in all rows of strands located between the cracks and one strand from all rows of strands located adjacent to the outer edge of the cracks.

Note: The intent is to disregard all strands that could intersect the crack and be exposed to air and moisture.

DETERIORATION

- 1) Exposed strands observed with sound concrete adjacent to and above the exposed strands:
Disregard exposed strands only.
- 2) Exposed strands observed with unsound concrete adjacent to and above the exposed strands:
Disregard exposed strands and all strands located in rows above and immediately adjacent to the area of unsound concrete.
- 3) Exposed reinforcement bars observed (#3 or #4 stirrups typically extending less than 1-foot in from the sides of the beam):
Disregard the strands located in the lower row directly above the exposed stirrups. If the concrete is found to be unsound adjacent to the exposed reinforcement bars, disregard all strands in all rows located above the area of unsound concrete.
- 4) Exposed wire mesh or full width reinforcement stirrup bars observed on bottom of beam:
Judge whether or not the wire mesh or reinforcement bars are in contact with the strands.

- If in contact, disregard all strands in the lower row directly above the exposed wire mesh or stirrups.
- If not in contact but the concrete adjacent to the exposed wire mesh or stirrups is found to be unsound, disregard all strands located above the area of unsound concrete.
- If not in contact and concrete adjacent to the exposed wire mesh or stirrups is sound, do not disregard strands during analysis.

5) Areas of delaminated concrete observed:

Remove all delaminated concrete to determine the depth of concrete deterioration.

- If reinforcement stirrup bars, wire mesh or strands are exposed, treat as in "1" through "4" above.
- If no reinforcement, mesh or strands are exposed but there are indications that the exposed concrete is unsound within the affected area, disregard all strands located in the rows of strands above the area.
- If no reinforcement, mesh or strands are exposed in the affected area and concrete in the area is found to be sound, do not disregard strands in analysis.

6) Wet or stained areas observed on bottom or side of beams:

Closely inspect the wet or stained area to determine the soundness of the concrete.

- If close inspection indicates that concrete is unsound or delaminated, treat as in "5" above.
- If close inspection confirms that the concrete is sound, do not disregard strands in analysis.

Note: Wet and/or rust stained areas should be watched closely. These areas will be the next areas to experience significant deterioration.